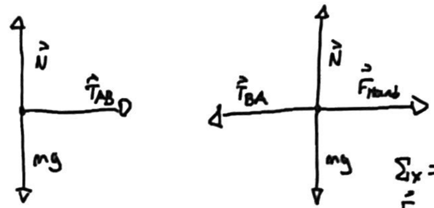
Hw Monday
Ch 7. Concept Q. 13
Ch 7. Prob Q. 38, 40
Ch 8. Concept Q. 4
Ch 8. Prob 6, 13
Supp Ex 46, 52

Taylor Larrechea
10:00 – 10:50 A.M

14.5/15

Ch7. Concept
13.)

$\Sigma_x = ma_x$
$\vec{F}_{Hand} - \vec{T}_{BA} = ma_x$
$\vec{F}_H = \vec{T}_{BA} + ma_x$
The force of the hand is greater than the tension of B on A

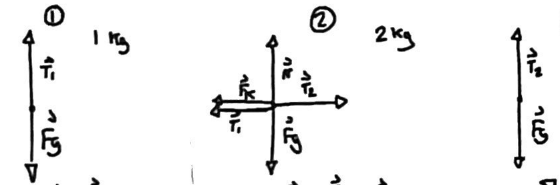


$\Sigma_x = ma_x$
$\vec{F}_H - \vec{T}_{BA} = ma_x$
$\vec{F}_H = ma_x + \vec{T}_{BA}$

Ch 7. Problems
38.)

① 1 kg ② 2 kg ③ 3 kg

μ_K



$a = 2.29\ m/s^2$

3/3

$\Sigma_y = \vec{T}_1 - \vec{F}_g = m_1 a$
$\vec{T}_1 - mg = m_1 a$
$\vec{T}_1 - m_1 g = m_1 a$
$\vec{T}_1 = m_1 g + m_1 a$

$\Sigma_x = \vec{T}_2 - \vec{F}_K - \vec{T}_1 = m_A a$
$\Sigma_y = \vec{N} - \vec{F}_g = 0$
$\vec{N} = m_2 g$

$\Sigma_y = \vec{T}_2 - \vec{F}_g = -m_3 a$
$\vec{T}_2 - mg = -m_3 a$
$\vec{T}_2 - m_3 g = -m_3 a$
$\vec{T}_2 = -m_3 a + m_3 g$

$-m_3 a + m_3 g - \mu_K \vec{N} - (m_1 g + m_1 a) = m_2 a$
$-m_3 a - m_1 a + m_3 g - m_1 g - \mu_K \vec{N} = m_2 a$
$-m_3 a - m_1 a - m_A a = -m_3 g + m_1 g + \mu_K \vec{N}$
$a(-m_3 - m_1 - m_A) = (-m_3 + m_1 + \mu_K m_2) g$

$a = \dfrac{(-m_3 + m_1 + \mu_K m_2) g}{-m_3 - m_1 - m_2}$

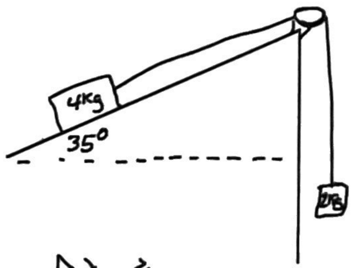
$a = \dfrac{(-3.0kg + 1.0kg + 0.30(2.0kg)) g}{-3.0kg - 1.0kg - 2.0kg}$

$a = \dfrac{(-1.4kg) g}{-6kg}$

$a = \dfrac{-13.72N}{-6kg}$

$a = 2.29\ m/s^2$

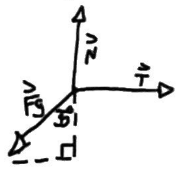
40.)



A. At rest
$\vec{T} = 22.5N$

B. If the box were to be relieved of tension it would move down the slope due to the their being an x-component of the force of gravity.

C. $\vec{T} = 20.6N$



F	X	Y
$\vec{N}$	0	N
$\vec{T}$	T	0
$\vec{F}_g$	-mgsin35	-mgcos35

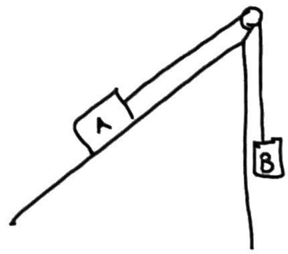
$\vec{T} - mg\sin 35 = ma_x$
$\vec{N} - mg\cos 35 = ma_y$

$\Sigma F_y = 0$: $N - mg\cos 35 = 0$ $m = 4.0\ kg$
$\vec{N} = mg\cos 35$ $g = 9.8\ m/s^2$
$\vec{N} = 4.0kg \times 9.8\ m/s^2 \times \cos(35)$
$\vec{N} = 32.1\ N$

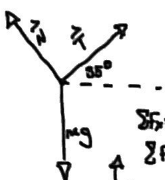
x-comp
$-\vec{F}_g \sin 35$
y-comp
$-\vec{F}_g \cos 35$

$\vec{F}_g = mg$

$\Sigma F_x = 0$: $T - mg\sin 35 = 0$
$m = 4.0kg$
$g = 9.8\ m/s^2$
$\vec{T} = mg\sin 35$
$\vec{T} = 4.0kg \times 9.8\ m/s^2 \times \sin 35$
$\vec{T} = 22.5N$



Ⓐ

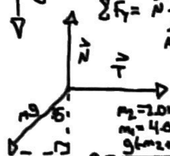


$\Sigma F_x = \vec{T} - m_1 g\sin\theta = -m_1 a$
$\Sigma F_y = \vec{N} - m_1 g\cos\theta = 0$
$\vec{N} = m_1 g\cos\theta$

Ⓑ

$a = 0.48\ m/s^2$
$m_2 = 2.0\ kg$
$g = 9.8$

$\Sigma_y = \vec{T} - m_2 g = m_2 a$
$\vec{T} = m_2 g + m_2 a$
$\vec{T} = 2.0kg(9.8) + 2.0kg(.48)$
$\vec{T} = 20.56\ N$



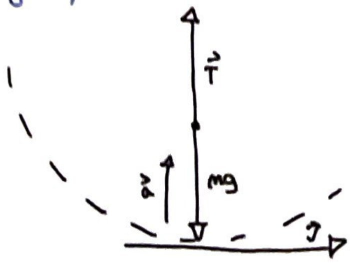
F	X	Y
mg	mgsin35	mgcos35
$\vec{N}$	0	N
$\vec{T}$	$\vec{T}$	0

$m_2 = 2.0kg$
$m_1 = 4.0kg$
$a = \dfrac{g(-m_2 + m_1\sin\theta)}{(m_2 + m_1)}$
$a = 0.48\ m/s^2$

$(m_2 g + m_2 a) - m_1 g\sin\theta = -m_1 a$
$m_2 a + m_1 a = -m_2 g + m_1 g\sin\theta$
$a(m_2 + m_1) = g(-m_2 + m_1\sin\theta)$

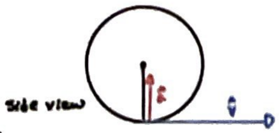
Ch 8.) concept Q

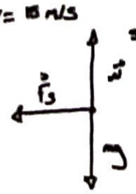
4.) Since the acceleration is centripetal and the acceleration points up, the net force points up. So therefore the tension has to be greater than gravity.



Ch 8.) Problems

6.) m = 1500 Kg
r = 50 m
V = 15 m/s





$\mu_s \vec{N} = \vec{f_s}\ max$

$V = \omega r \quad a = \omega^2 r$
$a = \frac{v^2}{r}$

$\vec{N} - mg = 0$
$\vec{N} = mg$
$\vec{N} = 1500\ Kg \cdot 9.8\ m/s^2$
$\vec{N} = 14{,}700\ N$

$a = \frac{(15\ m/s)^2}{50\ m}$

$a = 4.5\ m/s^2$

$\omega^2 = \frac{a}{r}$
$\omega = \pm\sqrt{\frac{a}{r}}$

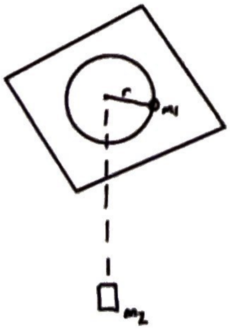
Force of friction is 6,750 N

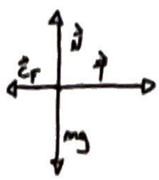
$\Sigma_x = ma_x = -\vec{F_s} = ma_x$

$-\mu_s \vec{N} = 1500\ Kg\ (4.5\ m/s^2)$

$\vec{f_s} = ma_x$
$\vec{f_s} = 1500\ Kg \cdot 4.5\ m/s^2$
$\vec{f_s} = 6{,}750\ N$

13.)





m_2
$\Sigma_y = 0 \quad \vec{T} - mg = 0$
$\vec{T} = m_2 g$

m_1
$\Sigma_y = 0 \quad \vec{N} - mg = 0$
$\vec{N} = mg$

$\Sigma_x = max \quad \vec{T} - \vec{F_r} = 0$
$\vec{T} - ma = 0$
$\vec{T} = m_1 (\frac{v^2}{r})$

$m_1 (\frac{v^2}{r}) = m_2 g$

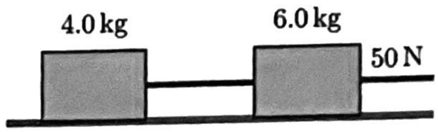
$\frac{v^2}{r} = \frac{m_2 g}{m_1}$

$\boxed{v^2 = \frac{r \cdot m_2 \cdot g}{m_1}}$

$v^2 = \frac{r \cdot m_2 \cdot g}{m_1}$

44 Connected objects: tension and acceleration

Two boxes can move along a horizontal surface. There is no friction between either box and the surface. The boxes are connected by a rope. A hand pulls on the other rope with force 50 N.

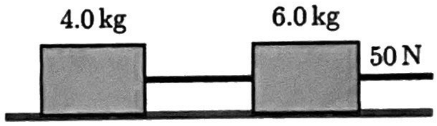


a) Determine the acceleration of each box.

b) Determine the tension in the rope connecting the boxes.

45 Connected objects: friction

Two boxes can move along a horizontal surface. There is no friction between the 6.0 kg box and the surface. There is friction for the other box: the coefficient of static friction is 0.70 and the coefficient of kinetic friction is 0.50. The boxes are connected by a rope. A hand pulls on the other rope with force 50 N.

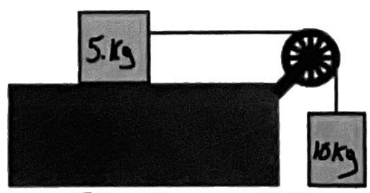


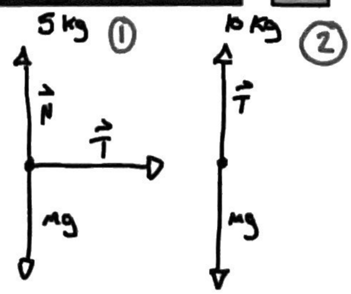
a) Determine the acceleration of each box.

b) Determine the tension in the rope connecting the boxes.

46 Dynamics of connected objects; level/suspended blocks without friction

Two blocks are connected by a string, which runs over a massless pulley. A 10 kg block is suspended and a 5.0 kg block can slide along a frictionless horizontal surface. The string connected to the block on the surface runs horizontally. The blocks held at rest and then released. They move, constantly speeding up. Which of the following is true regarding the tension in the connecting string, T, while they move? Explain your choice.





i) $T = 0$.

ii) $98\,\mathrm{N} > T > 0$.

iii) $T = 98\,\mathrm{N}$.

iv) $T > 98\,\mathrm{N}$

$\vec{T} = 96.5$ N

98N > 96.5N > 0

$m_2 g - m_2 a = m_1 a$

$m_2 g = m_1 a + m_2 a$

$g(m_2) = a(m_1 + m_2)$

$a = \frac{m_1 + m_2}{g m_2}$

$m_1 = 5$ kg

$m_2 = 10$ kg

$g = 9.8$ m/s²

$\vec{N} = 49$ N

$a = \frac{5\,kg + 10\,kg}{9.8\,m/s^2 (10\,kg)}$

$a = 0.15$

$\Sigma x = m_1 a_x$

$\vec{T} = m_1 a_x$

$a_x = a_y$

$\Sigma y = 0$

$\vec{N} - m_1 g = 0$

$\vec{N} = m_1 g$

$m_1 = 5$ kg

$\vec{N} = 5\,kg \cdot 9.8\,m/s^2$

$\Sigma y = -m_2 a_y$

$\vec{T} - m_2 g = -m_2 a$

$\vec{T} = m_2 g - m_2 a$

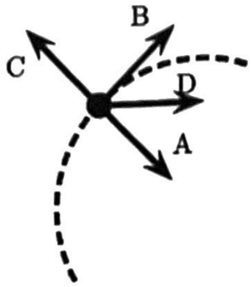
$m_2 = 10$ kg $\quad a = 0.15$ m/s²

$\vec{T} = 10\,kg(9.8\,m/s^2) - 10\,kg(0.15)$

$\vec{T} = 96.5$ N

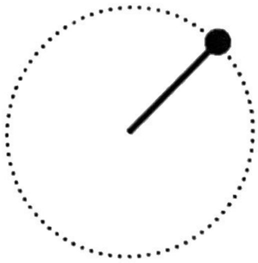
51 Bug walking in a circle

A bug walks at a constant speed in a circular path on a horizontal surface. Which vector best illustrates the net force on the bug at the illustrated moment? Explain your choice.



52 Ball swinging in a vertical circle

A 0.20 kg ball swings with in a vertical circle at the end of a string of length 0.50 m.



a) Draw a free body diagram for the ball at the highest point of the circle. Draw a free body diagram at the lowest point.

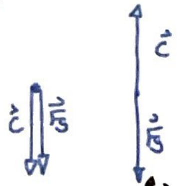
b) Suppose that the speed of the ball is constant throughout its motion. How does net force at the highest point of the circle compare (larger, smaller, same) to that at the lowest point of the circle? Use you answer to compare (larger, smaller, same) the tension in the string at the lowest point of the circle to the tension at the highest point of the circle.

c) Suppose that the string will break if the tension in it exceeds 5.0 N. Use Newton's second law to analyze the situation where the tension is largest (i.e. highest or lowest point) and determine the maximum speed with which the ball can move so that the string does not break.

d) In general the speed of the ball can vary as it swings. As the speed decreases does the tension at the top of the circle increase, decrease or stay constant? Determine the minimum speed so that the tension is not zero. Describe what happens if the speed drops beneath this.

Answers for 52 on next page

a.) Highest Lowest



$\vec{C}$ = centripetal force

$\vec{Fc}$ = centrifigal force

b)

Highest Point

$\Sigma_y = \vec{Fc} - \vec{T} - mg = 0$

① $-\vec{T} = mg - \vec{Fc}$

$\vec{T} = \vec{Fc} - mg$

Net force at highest point is less than at lowest.

same $F_{net} = mv^2/r$

$-(0.5)$

Lowest Point

$\Sigma_y = \vec{T} - \vec{Fc} - mg = 0$

② $\vec{T} = mg + \vec{Fc}$

c) Lowest Point

$\Sigma_y = 5.0N = mg + ma_c$

$m = 0.20kg$

$R = 0.50m$

$5.0N = mg + m\left(\frac{v^2}{r}\right)$

$5.0N - mg = m\left(\frac{v^2}{r}\right)$

$\frac{5.0N - mg}{m} = \frac{v^2}{r}$

$V = 2.76 m/s$

$r\left(\frac{5.0N - mg}{m}\right) = v^2$

$v = 2.76 m/s$

2.5/3

d) Highest point

$\vec{T} = \vec{Fc} - mg$

$\vec{T} = 0$: $0 = \vec{Fc} - mg$

$mg = \vec{Fc}$

$\vec{Fc} = ma_c$

$mg = ma_c$

$g = a_c$

$g = \frac{v^2}{r}$

$r = 0.5 m$

$g = 9.8 m/s^2$

$V^2 = 4.9 m/s^2$

$V^2 = r(g)$

$V^2 = 0.5m(9.8 m/s^2)$

$V^2 = 4.9 m/s^2$

$\checkmark = \ldots$